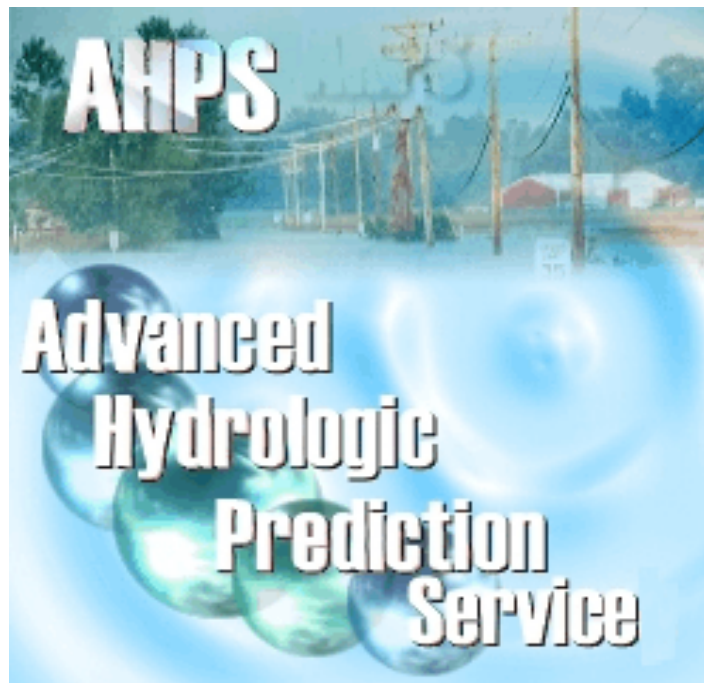




Advanced Hydrologic Prediction Service FY 2005 Program Activities



August 24, 2000

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Preface

The Advanced Hydrology Prediction Service (AHPS) FY 2005 program is modified from the FY 2004 program structure. This year, the program is coordinated to be more responsive to NWS field needs and more manageable through the use of focused theme areas to provide:

- Service enhancements for
 - Flash Flood,
 - Short- to Long-term Forecasts, and
 - Flood Mapping and Graphical Dissemination;
- National web page consistency;
- COMET Hydrology training;
- Collaborative Research; and
- Implementation for
 - 386 new AHPS service locations,
 - Software enhancements to directly support new services,
 - National and Regional Outreach, and
 - Program Management.

The focused theme areas are structured with teams composed of operational personnel from River Forecast Centers, Hydrologic Services Division personnel from the Office of Services (OCWWS) and Regional offices, along with science and development personnel. The objective behind this structure is to enable those most knowledgeable with field operations, services and development to provide direction and oversight for the area. A program benefit in this team structure is the formation of tighter linkages among focused area tasks and to ensure an end-to-end process from science development to services delivery.

Within the AHPS program, each team is empowered to recommend and monitor tasks to be performed with the assistance of AHPS resources. Each team has a lead member responsible to oversee development of the focused area program plan and to assure integration with other theme areas as appropriate. Team recommendations will be reviewed and approved by the ARC and confirmed by NOAA's Hydrology Program Manager. This confirmation step is inline with the ARC Terms of Reference and the NOAA Hydrology Program, i.e., AHPS is part of NOAA's Hydrology Program. The AHPS Program Office will coordinate the formulation of plans and project monitoring documentation with each team for review by the ARC and NOAA's Hydrology Program Manager.

This document presents activities of the Advanced Hydrologic Prediction Service (AHPS) FY 2005 program. The activities focus on the following priorities developed through external user and internal NWS meetings (including the Development and Operations Hydrologist / RFC Development Management Science Workshop, June 7-11, 2004 and the Hydrologist-in-Charge Meeting of July 13-15, 2004):

- Provide capability to deliver short-range ensemble forecasts;
- Provide a consistent web presence for NWS hydrologic information on the Internet;
- Improve the hydrologic operations infrastructure to support the development and integration of new services;
- Use models of other water agencies to support NWS hydrologic services; and

- Provide service enhancement for flash-flood forecasts using high-resolution geographic information system (GIS) and hydrometeorological data sets.

FY2005 Program Breakdown

Title: Advanced Hydrologic Prediction Service (AHPS)

Amount: \$6,098,000

The FY2005 program expands AHPS in the Southeast, Midwest, and Mid-Atlantic States and delivers:

- Service enhancements for
 - Flash Flood,
 - Short- to Long-term Forecasts, and
 - Flood Mapping and Graphical Dissemination;
- National web page consistency;
- COMET Hydrology training;
- Collaborative Research; and
- Implementation for
 - 386 new AHPS service locations,
 - Software enhancements to directly support new services,
 - National and Regional Outreach, and
 - Program Management.

Cost breakdown by major cost components (\$K):

Flash Flood Services: supports the enhancement and field implementation of high resolution hydrologic models to account for snow pack, watershed runoff, and small basin geomorphology.	1,189
Short- to Long-Term Forecasts: incorporates precipitation and temperature forecasts into probabilistic streamflow predictions for periods of from 1 day through 3 months.	930
Flood Mapping and Graphical Dissemination: provides new graphic tools for river and flood forecast operations; and delivers new GIS-based displays of river stage, flood, and drought information to better meet customer needs.	389
Web Page Management: supports the provision of nationally consistent streamflow observation and forecast information via the internet.	245
COMET Training: provides for DOH residence courses and distance learning on new science and products.	200
Collaborative Research: funds extramural partnerships to conduct use-inspired hydrologic research projects.	500
Implementation	
New Service Locations: enables National Weather Service River forecast offices Forecast Centers to implement locally adjusted river forecast models and produce probabilistic forecasts.	1,545
Software Infrastructure and Integration: enables the National Weather Service River Forecast Centers to account for streamflow regulation in probabilistic forecasts and integrate gridded meteorological data and externally developed model techniques.	700
National and Regional Outreach: provides for workshops to train WFO forecasters and educate customers and partners.	100
Program Management: provides for program planning, execution and reporting within the Department and in partnership with Legislative Affairs.	300
Total	\$6,098K

AHPS FY05 Budget (\$6.1M PB)

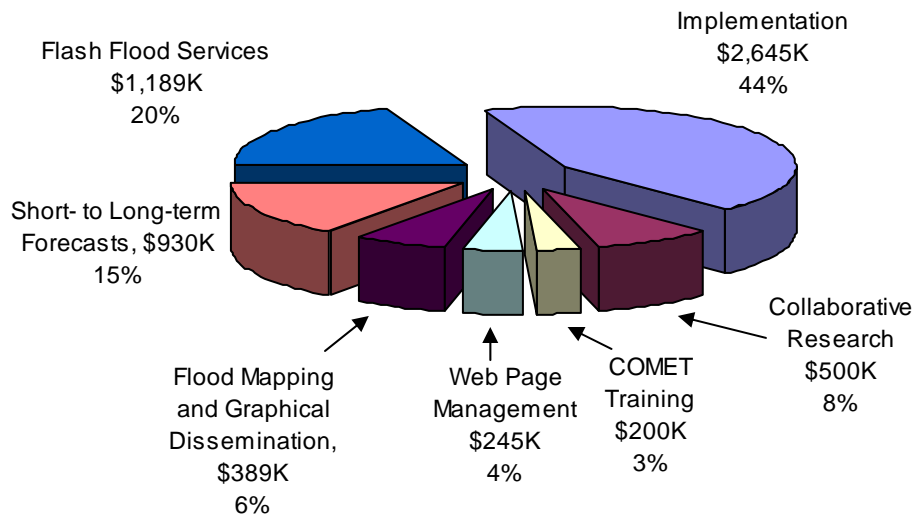


Figure 1. Advanced Hydrologic Prediction Service (AHPS) FY 2005 Budget Breakout.

Flash Flood Services	Short- to Long-term Forecasts	Flood Mapping & Graphical Dissemination
\$1,189,000	\$930,000	\$389,000
<p>Team: Tom Donaldson* and Mary Mullusky, OCWWS/HSD; Dave Kitzmiller and Mark Glaudemans, OHD; Stephan Smith, OST/MDL; and <i>Field Representative</i></p>	<p>Team: <i>Dave Brandon*</i>, CBRFC; <i>Gregg Rishel</i>, NERFC; Mary Mullusky and Kevin Lynott, OCWWS/HSD; and Pedro Restrepo, Mike Smith, and Edwin Welles, OHD</p>	<p>Team: <i>Joe Ostrowski*</i>, MARFC; Tom Donaldson, OCWWS/HSD; Doug Marcy, NOS/CSC; and Janice Sylvestre, OHD</p>
<p>Deliverables:</p> <ul style="list-style-type: none"> • Qualitative Precipitation Estimate <ul style="list-style-type: none"> ○ Enhancement to the Multisensor Precipitation Estimator (MPE) to include Mountain Mapper functionality ○ National implementation of local analysis techniques for merging unbiased radar data with gage rainfall data ○ Increase MPE space/time resolution to 1 degree x 1 km and less than 1 hour precipitation refresh ○ Integrate satellite information into MPE calculations • Hydraulic Modeling and Analysis Tools <ul style="list-style-type: none"> ○ Clean up data used for Dam Break forecast to address WFO need for accurate emergency guidance during dam failure scenarios ○ Simplified Hydraulic Routing Technique (SHRT) to provide water surface elevation for locations not requiring open channel hydraulic flow equations • Flash Flood Monitoring and Prediction (FFMP) <ul style="list-style-type: none"> ○ Incorporate MPE with higher resolution temporal and special resolution ○ Add multiple monitoring time frames and thresholds 	<p>Deliverables:</p> <ul style="list-style-type: none"> • Short-term Ensemble <ul style="list-style-type: none"> ○ Precipitation and temperature pre-processing techniques suitable for the generation of short-term ensemble river forecasts • Distributed Hydrologic Modeling System (DHMS) <ul style="list-style-type: none"> ○ Deliver a DHMS to the RFCs which processes finer spatial detail of soil condition for improving short- and long-term river forecasts • Verification <ul style="list-style-type: none"> ○ Techniques to verify the probabilistic and deterministic forecasts 	<p>Deliverables:</p> <ul style="list-style-type: none"> • Integrated NWS flood mapping application (FLDVIEW) to provide flood inundation capabilities to all RFCs for providing GIS based flood information • Implement the first phase of the AHPS Product and Information Team (APIT) recommendations

* Team Lead

Web Page Management	COMET Training	Collaborative Research
\$245,000	\$200,000	\$500,000
Team: Donna Page*, OHD; Frank Richards and Kevin Lynott, OCWWS/HSD; <i>Michelle Schmidt, WR/HSD and Field Representative</i>	Team: Jeff Zimmerman*, OCWWS/HSD; Donna Page, OHD; <i>Ken King, CR/HSD and Field Representative</i>	Team: Pedro Restrepo*, OHD; <i>Rob Hartman, CNRFC and Bob Tibi, WR/HSD</i>
Deliverables: <ul style="list-style-type: none"> • Enhance Web pages by adding new AHPS forecast locations, updating maps, etc. • Implement HydroGen in AWIPS • Implement National Forecast Location Database 	Deliverables: <ul style="list-style-type: none"> • Provide DOH Residence Courses <ul style="list-style-type: none"> ○ Flash Flood Hydrology and QPE Workshop ○ 1st Advanced Hydrologic Science Workshop • Provide Distance Learning <ul style="list-style-type: none"> ○ Basic Hydrologic Science ○ Workshop on Ensemble Hydrologic Forecasts 	Deliverables: <ul style="list-style-type: none"> • Sustain university relationships begun in FY04 • Expand research to deliver top consensus HIC priorities <ul style="list-style-type: none"> ○ Short-Term Ensemble Forecasts ○ Streamflow Regulation ○ Probabilistic Verification ○ Short-Medium-Long Range Ensemble Integration ○ NWSRFS calibration process improvement • Address societal impacts, economic benefits and decision support tools

* Team Lead

Implementation (\$2,654K)			
New Service Locations	Software Infrastructure and Integration	National and Regional Outreach	Program Management
\$1,545,000	\$700,000	\$100,000	\$300,000
Team: Donna Page*, OHD and <i>Robin Radlein, AP/HSD</i>	Team: Jon Roe* and Janice Sylvestre, OHD; <i>Larry Black, MBRFC; and Dave Brandon, CBRFC</i>	Team: Tom Graziano*, OCWWS/ HSD and <i>Ben Weiger, SR/HSD</i>	Team Leads: John Ingram*, OHD; Tom Graziano, OCWWS/HSD; and <i>Peter Gabrielsen, ER/HSD</i>
Deliverables: <ul style="list-style-type: none"> • Provide AHPS at 386 new locations • Provide information for Alaska flight lines • Conduct evaluation on national calibration requirements and approach 	Deliverables: <ul style="list-style-type: none"> • Streamflow Regulation: Necessary to implement AHPS at several locations • Short-term ensemble software development: Needed to implement enhanced services at AHPS points • River Ensemble Processor (REP) software architecture: Allows integration of gridded meteorological data and externally developed modeling techniques 	Deliverables: <ul style="list-style-type: none"> • Regional workshops to train WFO forecasters • Regional workshops to educate our customers and partners about AHPS products and services • HPC Visiting Forecaster 	Deliverables: <ul style="list-style-type: none"> • Planning/Execution/Reporting • Agency/Departmental/Legislative Interface • HOSIP Management • Implement new Probabilistic Performance Measure

* Team Lead

FY 2005 Projects

DRAFT

Flash Flood Services

Team: Tom Donaldson* and Mary Mullusky, OCWWS/HSD; Dave Kitzmiller and Mark Glaudemans, OHD; Stephan Smith, OST/MDL; and *Field Representative*

Objectives: Service enhancements will be realized through the use of the Flash-Flood Monitoring and Prediction (FFMP) system which uses flash-flood guidance along with high-resolution quantitative precipitation estimates (QPE) from radar, ground based gauges, and satellites as well as short-term quantitative precipitation forecasts (QPF) to determine areas of flash flooding. Advanced hydrologic models (distributed), dam failure analysis tools, and processing of high resolution geographic information system (GIS) and hydrometeorological data sets will also allow products to include much more detailed information on the location and magnitude of events. New products for additional locations in smaller basins will contain information in the form of numerical forecast values (e.g., stage or water level) or categorical threat levels (e.g., minor, moderate, major).

Need: Support the enhancement and field implementation of high resolution hydrologic models to account for snow pack, watershed runoff, and small basin geomorphology.

Tasks	Responsible Organization	Cost (\$)	Completion Date
		FY05	
QPE			
Distributed Model			
Hydraulic Modeling and Analysis			
FFMP			
Total Cost		\$1,189,000	

FY05 Task Deliverables by Quarter

- **Qualitative Precipitation Estimate**
 - Enhancement to the Multisensor Precipitation Estimator (MPE) to include Mountain Mapper functionality, *Qtr #*
 - National implementation of local analysis techniques for merging unbiased radar data with gage rainfall data, *Qtr #*
 - Increase MPE space/time resolution to 1 degree x 1 km and less than 1 hour precipitation refresh, *Qtr #*
 - Integrate satellite information into MPE calculations, *Qtr #*

- **Distributed Model**
 - Evaluate data sources and data quality to run budget snow models, *Qtr #*
 - Verify output data to enhance a complete distributed model capability within NWSRFS for all RFCs, *Qtr #*
- **Hydraulic Modeling and Analysis Tools**
 - Clean up data used for Dam Break forecast to address WFO need for accurate emergency guidance during dam failure scenarios, *Qtr #*
 - Simplified Hydraulic Routing Technique (SHRT) to provide water surface elevation for locations not requiring open channel hydraulic flow equations, *Qtr #*
- **Flash Flood Monitoring and Prediction (FFMP)**
 - Incorporate MPE with higher resolution temporal and special resolution
 - Add multiple monitoring time frames and thresholds

Out Year Plans to be developed in FY 2005 by Quarter

- Coordinate among OCWWS/HSD and the Regions a Site-Specific Hydrologic Prediction (SSHP) Concept of Operations (*taken from AHPS Q & As and AHPS Development and Implementation Plan*), *Qtr #*

The Concept of Operations will address field needs and identify specific SSHP projects, including snow modeling. Additional work needed to support operational use of the Site Specific/SAC-SMA includes:

- Software Tools for Model Calibration – Existing River Forecast Center (RFC) calibrations are made for larger basins and time steps (6-hour) than Site Specific/SAC-SMA, which can operate on smaller basins with a 1-hour time step;
- Maintain Model State Variables – Maintaining the proper values for model state variables is critical in producing accurate and meaningful forecasts. This will be accomplished by integrating a variational assimilation, VAR, state adjustment function into the Site Specific/SAC-SMA; and
- Implement Routing & Snow Modeling Techniques – This will allow the Site Specific model to be used for additional hydrologic conditions.

Short- to Long-Term Forecasts

Team: *Dave Brandon**, CBRFC; *Gregg Rishel*, NERFC; Mary Mullusky and Kevin Lynott, OCWWS/HSD; and Pedro Restrepo, Mike Smith, and Edwin Welles, OHD

Objectives: Incorporate precipitation and temperature forecasts into probabilistic streamflow predictions for periods of from 1 day through 3 months.

Need: Short- to long-term forecasting services, referred to as the Ensemble Streamflow Prediction (ESP) system, add a probabilistic forecasting capability within NWSRFS to increase the accuracy of forecasts and to convey a quantitative measure of the forecast uncertainty. The ESP system aims to produce short term (hours to five days), medium term (six to fourteen days), and long term (monthly to seasonal) probabilistic forecasts. In AHPS, probabilistic forecasting addresses the process of assessing the uncertainty of forecasts and provides additional information and products based on that uncertainty. One way to produce probabilistic forecasts is by means of ensembles. Ensemble prediction provides the flexibility required to satisfy the complex mix of operational and scientific requirements associated with AHPS.

The main goals of developing the ESP system are:

- To produce seamless and consistent probabilistic forecasts for all lead times, relative to specific RFCs sub-areas at the appropriate time steps. The ESP system will integrate any available meteorological forecasts and will account for both forecast uncertainty and hydrologic model uncertainty.
- To verify ESP performance in both space and time.

Tasks	Responsible Organization	Cost (\$)	Completion Date
		FY05	
Total Cost		\$930,000	

FY 05 Task Deliverables by Quarter:

- **Short-term Ensemble**
 - Precipitation and temperature pre-processing techniques suitable for the generation of short-term ensemble river forecasts, *Qtr #*
- **Distributed Hydrologic Modeling System (DHMS)**
 - Deliver a DHMS to the RFCs which processes finer spatial detail of soil condition for improving short- and long-term river forecasts, *Qtr #*
- **Verification techniques to verify the probabilistic and deterministic forecasts**

Out Year Plans to be developed in FY 2005 by Quarter

DRAFT

Flood Mapping and Graphical Dissemination

Team: *Joe Ostrowski**, MARFC; Tom Donaldson, OCWWS/HSD; Doug Marcy, NOS/CSC; and Janice Sylvestre, OHD

Objective: Provide new graphic tools for river and flood forecast operations; and deliver new GIS-based displays of river stage, flood, and drought information to better meet customer needs.

Need:

Tasks	Responsible Organization	Cost (\$)	Completion Date
		FY05	
Total Cost		\$389,000	

FY05 Task Deliverables by Quarter

- **Deliver integrated NWS flood mapping application (FLDVIEW) in the AWIPS baseline, Qtr #**
Provides flood inundation capabilities to all RFCs to address customer requests for GIS based flood information
- **Implement the first phases of the AHPS Product and Information Team recommendations for customer demanded enhancements to the hydrology program service delivery, Qtr #**
 - Data basing of AHPS web products configuration information
 - Integrate customer feedback into enhanced river hydrograph
 - Develop NWS strategy for consistent precipitation graphics

Out Year Plans to be developed in FY 2005 by Quarter

Web Page Management

Team: Donna Page*, OHD; Frank Richards and Kevin Lynott, OCWWS/HSD; *Michelle Schmidt, WR/HSD and (Field Representative)*

Objectives: Provide a standard look and feel for the presentation of AHPS river observation and forecast information on the World Wide Web by all NWS weather offices. And, complete the implementation of a single national database that aggregates information on hydrologic observation and service locations used by WFOs and RFCs. Provide information in a GIS format that is Web accessible for easy access by all users.

Need:

Tasks	Responsible Organization	Cost (\$)	Completion Date
		FY05	
Total Cost		\$245,000	

FY05 Task Deliverables by Quarter

- Enhance Web pages by adding new AHPS forecast locations, updating maps, etc. , *Qtr #*
- Implement HydroGen in AWIPS, *Qtr #*
- Implement National Forecast Location Database, *Qtr #*

Out Year Plans to be developed in FY 2005 by Quarter

COMET Training

Team: Jeff Zimmerman*, OCWWS/HSD; Donna Page, OHD; *Ken King, CR/HSD* and *(Field Representative)*

Objectives: Develop Hydrologic Science Training for WFOs and RFCs

Need:

Tasks	Responsible Organization	Cost (\$)	Completion Date
		FY05	
Total Cost		\$200,000	

FY05 Task Deliverables by Quarter

- Provide hydrologic science component to COMET training capabilities, *Qtr #*
- Development of Residence Courses
 - Flash Flood Hydrology and QPE Workshop, *Qtr #*
 - 1st Advanced Hydrologic Science Workshop, *Qtr #*
- Development of Distance Learning
 - Basic Hydrologic Science, *Qtr #*
 - Workshop on Ensemble Hydrologic Forecasts, *Qtr #*

Out Year Plans to be developed in FY 2005 by Quarter

Collaborative Research

Team: Pedro Restrepo*, OHD; *Rob Hartman, CNRFC* and *Bob Tibi, WR/HSD*

Objective: This program represents a NOAA/NWS effort to create a cost-effective continuum of basic and applied research through collaborative research between the NWS and academic communities or other private or public agencies which have expertise in the hydrometeorologic, hydrologic, and hydraulic routing sciences. These activities will engage researchers and students in basic and applied research to improve the scientific understanding of river forecasting. Ultimately, these efforts will improve the accuracy of forecasts and warnings of rivers and flash floods by applying scientific knowledge and information to NWS research methods and techniques, resulting in a benefit to the public. NOAA's program is designed to complement other agency contributions to that national effort.

Need:

Tasks	Responsible Organization	Cost (\$)	Completion Date
		FY05	
Total Cost		\$500,000	

FY05 Task Deliverables by Quarter:

- Sustain university relationships begun in FY04
 - U. of Arizona, Distributed modeling
 - U. of Colorado, Ensemble forecasting
 - U. of Central Florida, Two dimensional hydrodynamic model
 - U. of Iowa, Ensemble verification
- Expand research to deliver top consensus HIC priorities
 - Short-Term Ensemble Forecasts
 - Streamflow Regulation
 - Probabilistic Verification
 - Short-Medium-Long Range Ensemble Integration
 - NWSRFS calibration process improvement
- Address societal impacts, economic benefits, and decision support tools

Out Year Plans to be developed in FY 2005 by Quarter

New Service Locations

Team: Donna Page*, OHD and Robin Radlein; AP/HSD

Objectives: Implement locally adjusted river forecast models and produce probabilistic forecasts.

Need:

Tasks	Responsible Organization	Cost (\$)	Completion Date
		FY05	
Total Cost		\$1,545,000	

FY05 Task Deliverables by Quarter

- AHPS at 386 new proposed locations

River Forecast Center	New Operational Forecast Locations
APRFC	
CBRFC	
CNRFC	
NWRFC	
ABRFC	
LMRFC	
SERFC	
WGRFC	
MBRFC	
NCRFC	
MARFC	
NERFC	
OHRFC	
Total	386

• Evaluation of national calibration requirements and approach. Considering:

- Identify a customer need/requirement (*base/AHPS*)
- Hydrologic Recon (*base*)
- Data Recon (*base*)
- Data Acquisition, Collection, and Validation (*AHPS/base*)
- Select Flow Points (forecast points) (*base*)
- Data Assimilation (*base/AHPS*)
- Flow Calibration (*AHPS/base*)
- Reservoir Simulation (*AHPS/base*)
- Flood Wave Analysis (*AHPS/base*)
- Stream Flow Regulation Analysis (*AHPS/base*)
- Implement in NWSRFS (*base*)
- Validate System (*base*)
- Implement Routine Operations (*base*)
- Verification (*base/AHPS*)

Items noted with “base” above are handled from RFC, WFO, Regional, OCWWS/HSD, or OHD base funded resources. Items noted with “AHPS” rely on the AHPS program implementation funding to accomplish. Primary source listed first.

Out Year Plans to be developed in FY 2005 by Quarter

Software Infrastructure and Integration

Team: Jon Roe* and Janice Sylvestre, OHD; *Larry Black, MBRFC; and Dave Brandon, CBRFC*

Objectives:

Need:

Tasks	Responsible Organization	Cost (\$)	Completion Date
		FY05	
Total Cost		\$700,000	

FY05 Task Deliverables by Quarter

Streamflow Regulation: necessary in order to implement AHPS at many locations

Short-term Ensemble software development: needed to implement enhanced services at AHPS points

River Ensemble Processor (REP) software architecture: allows integration of gridded meteorologic data and externally developed modeling techniques

Out Year Plans to be developed in FY 2005 by Quarter

National Regional Outreach

Team: Tom Graziano*, OCWWS/ HSD and *Ben Weiger, SR/HSD*

Objectives:

Need:

Tasks	Responsible Organization	Cost (\$)	Completion Date
		FY05	
Total Cost		\$100,000	

FY05 Task Deliverables by Quarter

Regional workshops to train WFO forecasters

Regional workshops to educate our customers and partners about AHPS products and services

Out Year Plans to be developed in FY 2005 by Quarter

Program Management

Team Leads: John Ingram*, OHD; Tom Graziano, OCWWS/HSD; and Peter Gabrielsen, ER/HSD

Objectives: Provide national program management; coordinate and track AHPS budgets and project plans; and manage AHPS contracts. And, foster agency, Departmental, and Legislative Interface

Need:

Tasks	Responsible Organization	Cost (\$)	Completion Date
		FY05	
Total Cost		\$300,000	

FY 05 Task Deliverables by Quarter

Budget formulation and program planning

- Provide support to NWS and NOAA budget and legislative offices
- Provide draft program theme plans to ARC April 2005
- Formulate budget to support AHPS FY06
- Provide FY06 project proposals to ARC July 2005
- Propose allocation of FY06 funds to ARC August 2005

Coordinate and monitor AHPS activities

- AHPS Quad Charts Monthly
- AHPS quarterly status reports Quarterly

Contract Management

- Coordinate Statements of Objectives for task activities
- Track task activities against proposed plans Monthly

Out Year Plans to be developed in FY 2005 by Quarter